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THE *EDINBURGH REVIEW* AND THE SPENCERIAN PHILOSOPHY.

BY RICHARD A. PROCTOR.

I HAVE just read the *Edinburgh Review* on Mr. Spencer's System of Philosophy, or rather on the first volume (First Principles) of the series relating to the system to which Mr. Spencer has given the appropriate name Synthetic Philosophy. I must confess to being saddened by the reading. The author of the review is one of those whose name is "writ large" in every line he pens. No one who has ever read a page from his pen can fail to recognise thereafter whatsoever he may write. A masterly advocate in a good cause, which is well though not always best in science, he here shows his power in special pleading for what I cannot but regard as a bad cause. I do not mean the cause of that philosophy for which he seems to contend, but his obvious wish to cast absurdities on (not to show absurdities in) the philosophy of one whose aims he detests. From the first lines of the review, in which he jeers at the letterpress and binding—"First Principles" inside, the "System of Philosophy" outside, and the "Synthetic Philosophy" on the back (where however "First Principles" appears in letter five times as large)—the review is unfair. The kind of ridicule cast on Mr. Spencer is such as a lover of the old Aristotelian philosophy might as effectively, nay much more effectively, have cast on Bacon's *Novum Organum*,—more effectively because in many matters Bacon was not abreast of the science of his day, and many of his suggestions were open to ridicule even in his own time, faults which cannot be urged against the teachings of the greater Bacon of our era.

To begin with, the author of the review touches on what would scarcely affect our estimate of a system of philosophy,—the language and even the grammar in which it is presented. He permits himself to say, "In quoting from Mr. Spencer, we must occasionally alter the grammar of a quotation to make it fit our own writing without abrupt changes." This, by the way, might not seem very severe criticism if the reviewer's writing were judged by the sentence immediately following, which begins thus, "No writer that we know of requires his definitions so carefully *attending* to, and the subsequent use of his defined terms so carefully *watching*." Only a few sentences before, the hypercritical reviewer (for I do not think any writer requires his writing so carefully attended to as for the moment I attend to his) speaks of something "which we should be sure to be told that we have misunderstood, or overlooked qualifying statements somewhere else,"—and I should very much like to hear his parsing of the words "which we should be sure to be told that we have overlooked qualifying statements," &c.,—[which it seems very bad grammar to me, or my last eight words good grammar, which they are not, nor which are the last four or these nine.]

If I smile at such trifles for a moment it is because the reviewer tries to give them prominence in pretending to deal with the Spencerian philosophy. He is perhaps wise in his generation. It is easier in this case to criticise style than matter; for such a subject as Mr. Spencer deals with in his "First Principles" is one in which the use of abstract language easily cavilled at is almost unavoidable.

When the *Edinburgh* reviewer attacks or rather tackles the subject matter of Mr. Spencer's volume, he still keeps clear of essentials to lay chief stress on misinterpreted words or manufactured absurdities. Among the latter the most remarkable perhaps is that, because Mr. Spencer speaks of the Unknowable First Cause as only known to us through the known effects of persistent force, therefore Mr. Spencer practically presents the Unknowable First Cause as identical with Persistent Force: whereas if there is a point on which Mr. Spencer lays special stress in dealing with THAT of which he speaks as the "First Cause, in every sense perfect, complete, total, including within itself all power and transcending all law," it is that It may be, nay must be, utterly unlike that by which we know of Its existence.

After this it is a trifle that the reviewer misrepresents Mr. Spencer in detail,—as for instance at p. 47, where he quotes professedly "a specimen of Mr. Spencer's most careful and precise style unreduced," yet omits several important words, and actually gives a concrete illustration of what he says he understands Mr. Spencer to mean, an illustration corresponding only with the garbled extract and naturally leading to an absurd abstract proposition.*

The reviewer takes Mr. Spencer to task for regarding the laws of Newton as results of experience, and points out that Newton himself established them by the "sufficient cause" argument. This is altogether new to me. In the "Principia" Newton presents these axioms as the results of experience and describes some of the experiments which establish them. In fact Newton uses the word "axiom" in its proper sense as meaning a fact or law established by experience and known to be worthy (ἄξιος) of acceptance.

From an attack such as this Mr. Spencer's work needs no defence. The reviewer says that Carlyle called something or other "clotted nonsense" and implies that the epithet may be properly applied to Mr. Spencer's philosophy. The true "clotted nonsense" story is very much at the reviewer's service, if he will condescend to accept an unadorned version. A choleric reviewer called Carlyle's

* The concrete illustration really corresponding to Mr. Spencer's abstract general statement would have been this,—If the indifferent mental idea conveyed to the mind by the aspect of a tiger leads always to the idea of physical injury and thus to the movements necessary for escape from the tiger's ferocity, it is a matter of no moment whether one idea or the other is identical with the reality or utterly unlike it. Of this it may be remarked, indeed, that it is obvious; but the very circumstance that a proposition can be laid down in abstract terms implies that any concrete example must be obvious. All the examples of the action of gravity are obvious,—but it required a Newton to deduce from them the Law of Gravitation.

"Sartor Resartus" "clotted nonsense"; and so it was no doubt to that angry writer: the *Edinburgh* reviewer, who seems to attach weight to what Carlyle wrote, would probably consider that criticism hasty and ill-judged, we may even say false and spiteful. The criticism has so far become a thing of the past that now, less than forty-five years after it was uttered, an admirer of Carlyle forgets that it was said *of* that writer and not *by* him. Perhaps in less time still our reviewer's angry abuse of Mr. Herbert Spencer may similarly have passed into oblivion.

THE EVOLUTION OF FLOWERS.

By Grant Allen.

I.—THE STARTING-POINT.

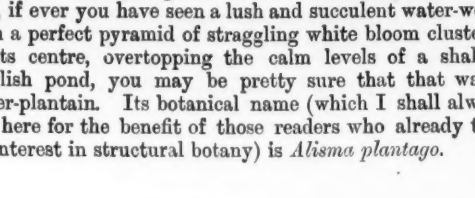
I PROPOSE in this set of papers that we should follow out together, so far as is possible, the various steps in the evolution of a single great group of plants, illustrated for the most part either by native English wild flowers, or by such common garden favourites as are within the easy reach and familiar knowledge of almost everybody. Starting from the simplest known form, which we may conceive to represent very nearly the peculiarities of the primitive ancestor, we must trace the gradual changes by which the various successively higher forms have been developed; and at each stage we must try to discover what was the advantage gained by the plant through the different new arrangements, and in consequence of what special agency these arrangements became finally stereotyped in the persons of its descendants. In this way, we shall obtain a more clear and connected view of the methods of evolution in the vegetable world than we could ever obtain by the study of mere casual isolated instances, and we shall be able more fully to understand the underlying meaning and reasons for the classifications long since half blindly (though very wisely) adopted by the earlier pre-Darwinian botanists. We shall see that the classes they mapped out are really genealogical divisions, and that all the members of each family or genus are really bound together by genuine ties of blood in their common descent from a single central and typical ancestor.

The great group of plants to which I propose to apply our present scrutiny is one that may be roughly described for unbotanical readers as that of the Lilies. Botanists will know more clearly what is meant if I say that our subject is to be the Monocotyledons, especially those with conspicuous petals or perianths, comprising the main central body of the class, from the Alismas up to the Orchids. This group may fairly enough be described throughout for popular purposes under the general name of Lilies, both because most of the flowers are moderately lily-like in form and texture, and because the true lilies occupy a central place in the class as a whole, presenting the peculiarities of the entire body in a comparatively simple and recognisable form.

What, then, is the simplest and most primitive existing type of lily, or, to speak more correctly, of Monocotyledon?

I believe, if we take relative simplicity in the arrangement of parts as our guide, we shall come to the conclusion that no lily-like plant is more primitive or antiquated in type than our own common English water-plantains. Let us begin, therefore, by looking briefly at the nature and structure of this familiar and pretty little British pond-haunter; and then let us inquire what are the marks which it still bears on its very face of its own archaic and ancient characteristics.

Everybody must often have seen and noticed the water-plantain, with its tall sparse whitish flowers rising in large, loose masses high above the stagnant surface of still pools or flooded ditches. It is a pretty, glossy-leaved plant, with long-stalked bright green blades, and a spreading panicle of starry little blossoms, which look white in the mass as you see them growing, but turn out to be delicately pink or rose-colour when you gather them for close inspection. In fact, if ever you have seen a lush and succulent water-weed, with a perfect pyramid of straggling white bloom clustered in its centre, overtopping the calm levels of a shallow English pond, you may be pretty sure that that was a water-plantain. Its botanical name (which I shall always add here for the benefit of those readers who already take an interest in structural botany) is *Alisma plantago*.



Alisma plantago.

Now, what are the reasons which induce us to begin our review of the lily tribe with this little inconspicuous English wild-flower? Well, let us premise first of all that evolution runs habitually from the simpler to the more complex; from the like to the unlike; from the less consolidated to the more consolidated. Suppose we find two flowers, one of which has five distinct petals, all alike, and the other of which, resembling it in every other way, has two of those petals specially modified into a peculiar form, we rightly conclude that the former is the more primitive and original of the two. Not necessarily that the second is directly derived from the first; about that we can only judge by means of very minute and circumstantial evidence; but that, at least, the first stands nearer in type than the second to the common ancestor from which both are presumably descended. Again, if we find one flower with five separate petals, and another just like it, only with the five petals united into a single tubular corolla, we once more rightly conclude that the former is more primitive and original than the latter. Distinctness of parts is almost always a mark of the early unconsolidated stage; coalescence of parts is almost always a mark of the later consolidated stage. For example, most simpler crustaceans have the body divided into several nearly equal and similar joints or segments; but in the crabs and lobsters, the princes among crustaceans, seven such segments have become united together to form the large head-piece with its single solid shell or carapace. In such a case, everybody can see at once that the union of

parts is an obvious sign of higher and more complete development.

If we look at the flower of the water-plantain, we shall similarly see that it presents many such symptoms of an early, uncompounded, simple type. In the technical language of botany, there is very little cohesion or adhesion among its parts: it shows us in the easiest and most separate form the ground-plan upon which all the lilies, high or low, are ultimately constructed. Only, while in the higher lilies we have to pick out the various component elements of the flower with some difficulty from their entangled and combined condition, in the water-plantain we get them all distinct and individualised, so that there need be no hesitation at all in recognising their nature and meaning.

This, in brief, is the original ground-plan of the blossom in the common ancestor from which the great lily group has ultimately descended. Its parts were all arranged in whorls of three members each. It must have had (as we know by comparison of all existing forms) first of all a protective calyx whorl of three outer green sepals, enclosing and shielding the unopened bud from all attacks of cold weather or greedy insects. Inside this must have come a second or corolla whorl of three brightly-coloured and delicate petals, intended for the attraction of its insect fertilizers. Within the petals, again, were the pollen-bearing stamens, arranged in alternate rows of three each; and of these rows there may have been one, two, three, or more; though the fact that most existing monocotyledons have six stamens apiece, or else exhibit traces of having originally had six, would seem to show that two rows were most probably the contingent possessed by the prime ancestor. Last of all, in the very centre, came the carpels or young seed-vessels, of which there were also three, six, nine, or more, according to circumstances.

To such a primitive ground-plan our existing English water-plantain very closely adheres. The little pale pink flowers that grow in loose flat bunches at the end of its branched stem are each divisible into very nearly the same divisions as the fancy flower we have here sketched out. Each of them has three small green calyx-pieces, quite separate from one another, and quite unlike the petals that adjoin them. Next it has three petals, larger and broader than the sepals, very delicate, and coloured white with a faintly roseate tinge. There are six stamens, arranged in two alternating rows of three outer and three inner, the former opposite the sepals, and the latter opposite the petals. Finally, in the centre there are a great many small, one-seeded, distinct carpels, from eighteen to thirty in number, arranged in a ring round a broad, flat receptacle, which forms the boss or axis of the whole flower.

It is to these carpels that we must most especially direct our attention at the outset, because they are, so to speak, the very patents of nobility of the Alisma family, the grand evidence that the water-plantain and its congeners do really form the most primitive existing members of the great lily group. In the first place, all the other lilies without exception (save only the Alisma family and a few closely related small orders) have the carpels more or less combined into a single compound ovary, the walls of the different carpels having coalesced, for a reason which we shall have hereafter to consider. In the second place, the number of carpels in the water-plantains is exceptionally large; and we know by the analogy of the buttercups, which are the simplest members of the other great group of flowering plants (the Dicotyledons), that primitive flowers always have a great many distinct carpels, and that with the advance towards higher types, the carpels tend to become reduced in number as well as to cohere with one another. In the third place, the water-plantains have only one seed in each carpel; and we also know by analogies elsewhere that primitive flowers always have only one seed in each carpel, but that more advanced types, while lessening the number of carpels, increase the number of seeds in each.

I know this first exposition has necessarily been a little dull, because we have here to dwell chiefly on fundamental points of structure, which are always dry, and to say very little about points of function and the practical use of parts, which are always comparatively interesting; but that could hardly be helped in an introductory sketch, where it is needful, above all things, that we should have a clear conception of the raw form from which we take our first departure. In future papers, I trust we shall be able to make the final development of the various lily-like plants from this simple original a little more graphic and a little less dull. Meanwhile, I hope my readers will try to master the first principles laid down in this opening part; as a firm grasp of the architectural plan of the water-plantain will greatly assist in following out the subsequent course of evolution on which we are about to embark.

One word more, as the preachers say, and I have done. It is a very significant fact that the water plantain and its congeners are all, without exception, aquatic plants of the marshes, ponds, and ditches. Now, it frequently happens that fresh-water animals and plants preserve for us very antique and otherwise extinct types—creatures of a sort which have become extinct in the fiercer competition of the great continents and the great oceans, but which have lingered on in the less-occupied reaches of inland rivers, lakes, or pools. It has been ingeniously noted that meres or ponds may be regarded in this respect as the aquatic analogues of oceanic islands, where so many very archaic forms have been preserved for us, far from the wild struggle for life which rages so incessantly in the wider stretches of land or water. Indeed, it may be said, roughly speaking, that almost all very early or primæval types of plants or animals yet existing belong to one or other of three peculiar habitats—islands, freshwater lakes or streams, and caves. And the one point these three habitats have in common is just this—freedom from competition save by the members of a very small and local fauna or flora.

GHOSTS AND GOBLINS.

By R. A. Proctor.

THERE are few subjects more perplexing, on a close examination, than the ideas of men about the supernatural (as distinguished from the religious). Whether we analyse particular superstitions and endeavour to understand what is actually believed respecting them, or whether, taking a wider view, we consider the origin of the widespread belief in supernatural agencies, we find ourselves beset with difficulties; and these are only preliminary to the great difficulty of all—that of determining how far it is reasonable or likely that any of the common ideas about the supernatural have any basis of fact whatever.

But the first difficulty to be encountered resides in oneself. I who write have my superstitions. If I simply had them and believed in them, there would be little difficulty. But I do not believe in them. I know that they exist, because on certain occasions I have felt them in operation. Every reader of these lines must have had similar experiences—vague terrors coming we know not whence, and refusing to be exorcised by reason; the feeling—not momentary though transient—that a sight or sound

is not of this world; and other sensations conveying to us a sense of the supernatural which we can neither analyse nor understand, and in which the reason has no real belief.

Perhaps the consideration of this very difficulty may throw some light on our subject, for it often happens that the key to an enigma is indicated by the more perplexing circumstances of the problem. If we dismiss for the moment all those superstitions which may fairly be regarded as derived from early impressions, or as resulting from mere ignorance, and consider the case of well-educated, carefully-trained, and not weak-minded persons, who nevertheless at times experience superstitious tremors, we may perhaps find some circumstances pointing to the very origin of the superstitions now so widely entertained.

One well-marked feature of these emotions is their occurrence in the hours of darkness. I am not speaking here of the feeling of discomfort and fear which many experience when in the dark. This feeling is itself worth inquiring into. But I now speak of the circumstance that even those who have no unpleasant sensations when in darkness, are nevertheless only exposed to certain emotions of superstitious terror at such times. Who, for instance, thoroughly enjoys a ghost story if it is told in a well-lighted room? I use the word "enjoy," because, as a matter of fact, the sensation I am now considering is not by any means a painful one, except in extreme cases, or with persons of weak nerves. It is a mysterious, indefinable thrill, with about the same proportion of pain and pleasure as in the feeling of melancholy experienced on certain still, bright days in spring; and it is as difficult to understand why darkness and stillness should be essential to one feeling as why brightness and stillness should be essential to the other.

There is a commonplace explanation which ascribes both these feelings to the unconscious recalling of the emotions of childhood. To the child, darkness conveys the idea of discomfort. All that is enjoyable to him after darkness has come on, is in the light and warmth of the room where he sits or plays. Cold and gloom are without—in the long passages, in the unused rooms, and, in a yet greater degree, outside the house. The childish mind finds, indeed, a strange significance in the words "the outer darkness." Now, one can understand that any circumstances recalling those feelings of childhood would bring with them a thrill, relieved from pain because reason tells us no real danger is present, and conveying something of pleasure much as the idea of warmth and comfort is suggested by the roar of distant winds, or the sound of rain, when we are sitting in a cozy room. And in like manner one can understand how a bright, still day in spring may bring back "in sweet and bitter fancy" the feelings of childhood.

Yet there is more in either sensation than the mere unconscious remembrance of childhood. Something much farther back in our natures, if I may so speak, is touched, when the soul thrills with unintelligible fears. The proof of this is found in the fact that the feeling exists in childhood—nay, is more marked among children than with grown persons. "This kind of fear," says Charles Lamb, who knew better than most men what it is, "predominates in the period of sinless infancy." And I think that in the same essay he touches the real solution of the mystery, or rather he presents that higher mystery from which this one takes its origin, when he says, "these terrors are of older standing—they date beyond body."

There is a curious story in Darwin's latest work, which he uses as an illustration of a theory yet more singular. "My daughter," he says, "poured some water into a glass close to the head of a kitten, and it immediately shook its feet." "It is well known," he had before said, "that cats dislike wetting their feet, owing, it is probable, to th having aboriginally inhabited the dry country of Egyp This explanation may not be the true one; but even if n the real explanation we may be sure is quite as singul Now the fact to be explained is analogous to the circu stance we are dealing with. We see in young creatur like kittens, habits which cannot have been acquired fr observation. These habits depend (almost certainly) inherited peculiarities of the brain's conformation. M it not be that it is so with the superstitious tremors have been considering? Those fears which affect childr too young to know what fear is, those fears which in af life are but partially under the control of reason, m indicate a condition of the brain inherited not from pare or grandparents, but through long lines of descent—ev perhaps, from the ages when to our savage progenit every unexplained sight or sound might indicate t presence of a lurking enemy. During long ages of sav life the conformation of the brain must have become p manently affected by the mental action resulting from t necessity for continual watchfulness against brute a human enemies. In the dark, particularly, such wat fulness was at once more requisite and more difficult; a it seems by no means unlikely that the anxious feeli which many experience constantly in the dark, as well those peculiar tremors which are occasionally experienc in the hours of darkness, depend on mental peculiarit inherited from our gloom-fearing savage ancestors.

As respects the ordinary feeling of dread in darkne although there can be no doubt that it is sometimes e gendered by the talk of foolish nurses to young childr (and, by the way, what an unhappy thing it is that many must pass through the mischievous ordeal of traini by foolish and ignorant persons), yet it is a mistake suppose that this is the sole or even the main cause. So children fear to be in darkness who have never heard ghost or goblin. "It is not book or picture," says La very justly, "or the stories of foolish servants, whi create these terrors in children. They can at most b give them a direction. Dear little T. H., who of a children has been brought up with the most scrupulo exclusion of every taint of superstition—who was ne allowed to hear of goblin or apparition, or scarcely to told of bad men, or to read or hear of any distressi story—finds all this world of fear, from which he has be so rigidly excluded, *ab extrâ*, in his own 'thick-comi fancies;' and from his little midnight pillow, this nur child of optimism will start at shapes unborrowed of tra tion, in sweats to which the reveries of the cell-damn murderer are tranquility. Gorgons and Hydras a Chimæras dire—stories of Celæno and the Harpies—m may reproduce themselves in the brain of superstition; b they were there before. They are transcripts, types—t archetypes are in us, and eternal."

Another remarkable circumstance in the superstitio impressions which affect those who have no real belief ghosts and goblins, is the singular intensity of such i pressions when aroused (in whatever way) immediately waking. Especially after dreaming, when the dream h been of an impressive nature, the mind seems exposed t ideas of the supernatural. One often finds it impossible understand, on waking again in full daylight, how t mind can possibly have entertained the feelings which h made night hideous or distressing. In remembrance, t matter seems like an experience of another person.

In passing it may be noticed that we perhaps owe dreams many of the common ideas about spiritual agencie Mr. Herbert Spencer accounts for the earliest belief in t supernatural "by man being led through dreams, shadow

and other causes, to look at himself as a double essence, corporeal and spiritual." And "the spiritual being is supposed to exist after death, and to be powerful." Mr. Tylor also has shown how dreams may have given rise to the notion of spirits; "for savages," says Darwin (stating Tylor's views), "do not readily distinguish between subjective and objective impressions. When a savage dreams, the figures which appear before him are believed to have come from a distance, and to stand over him, or, 'the soul of the dreamer goes out on its travels, and comes home with a remembrance of what it has seen.'" "Nevertheless," says Darwin presently, "I cannot but suspect that there is a still earlier and ruder stage, when anything which manifests power or movement is thought to be endowed with some form of life, and with mental faculties analogous to our own."

(To be continued.)

THE EMOTIONS IN INFANTS.

THAT the infant of a few weeks old should experience emotion must doubtless seem strange to all those ignorant deriders of babyhood, who imagine that an infant and a cabbage are about on a par as regards emotional susceptibility. The apparently causeless bursts of crying so frequently indulged in by infants, would by these sceptics be put down to cold, hunger, the convenient pin, or, indeed, to anything rather than to what they would probably term a mental cause.

And yet, a very little observation shows us that infants are as much a prey to some of the emotions as are adults. To fear, in particular, do they fall easy victims, anything new in the way of a marked sensation being apt to have for its first result a certain startling effect. Darwin relates that when his child was sixty-six days old he happened to sneeze in its hearing; whereupon it started violently, frowned, looked frightened, and cried rather badly, remaining for an hour afterwards in a state which in older persons would have been called nervous. Again, when the same child was four and a-half months old, Darwin made a loud snoring noise, which at once caused it to look grave and burst out crying; and when through forgetfulness he repeated this sound a few days later, the same result as before followed.

The young mother, brought up to believe that the state of dread needs for its development some previous experience of evil, is often at a loss to understand her child's manifestation of fear, at an age when its experience of evil is necessarily almost nil. The apparent mystery, however, is easily explained by reference to the facts of heredity. The fear shown by infants is, in a great measure, the inherited effect of the manifold dangers through which the race has passed in its primitive struggle for existence. The same dangers no longer menace us, but the traces of these past experiences still survive under the altered conditions of civilised life, and manifest themselves in such transmitted tendencies as the infant's instinctive terror of darkness, its nervous shrinking from angry voices, and its dread of carnivorous beasts. Analogous phenomena prevail among the brute creation, Mr. Grant Allen assuring us that unworried calves have been known to turn and make common headway against a town-bred, half-grown puppy, which had been turned into the same enclosure with them.

The mother's non-recognition of these hereditary fears leads often to such injudicious action on her part, that a child which might grow up comparatively fearless becomes a confirmed coward. To cite one instance out of many, let us merely take the common practice of putting children to sleep by themselves in dark rooms. Courage can be established by habit, it is true; but this does not mean submitting children to conditions which must inevitably engender fear. If, as is the fact, children instinctively dread darkness, and it is wished to habituate them to it, pains should be taken that their exposure to darkness should always have an accompaniment of reassuring circumstances, such as the mother's voice or contact. The fear which darkness tends to inspire being thus instantaneously counteracted, the child's nervous system is spared those shocks which render it so liable to fresh accesses of fear, till, as a mere matter of growth, the vague terrors incidental to darkness cease to affect it.

It may be urged that it is not always possible to let the child have some one with it when it is put to bed for the night. In that case, then, let no attempt be made to inure it to darkness, but place a night-light in the room. The efficacy of this expedient is best proved by the fact that, whereas a child who wakes up alone, and in total darkness, will scream violently and be some time before it can be got off to sleep again, the child in whose room a night-light burns will sometimes scarcely cry at all, and can be hushed off to sleep directly.

After fear, perhaps jealousy and anger are the most marked emotions to which the young infant is subject. Jealousy shows itself at the age of three months, sometimes a month earlier, particularly should the mother attempt to nurse any other child than her own. Darwin's son showed jealousy when his father fondled a large doll or dandled his infant sister; while one very bright, intelligent little girl of about nine months old could not bear her mother to speak caressingly to a canary which hung in the nursery.

With regard to anger, it is not easy to say at how early an age anger is felt, for the signs of anger and distress are so alike that one may think the child is in pain when actually it is in a passion. Darwin declares that when nearly four months old there could be no doubt, from the manner in which the blood gushed to his child's face and scalp, that he easily got into a violent passion. "A small cause sufficed; thus, when a little over seven months old he screamed with rage because a lemon slipped away, and he could not seize it with his hands. When eleven months old, if a wrong plaything was given him he would push it away and beat it;" and Darwin suggests that the beating was an instinctive sign of anger, like the snapping of the jaws by a young crocodile.

Many children get into a passion over being washed and dressed, and many apparently for no reason at all that can be assigned. Their treatment, then, calls for very judicious firmness in those who have the charge of them. Often, if the parent or nurse herself is of an irascible nature, the piercing screams of the child will exasperate her to the point of slapping or shaking it with every demonstration of temper. This procedure is as mistaken as the contrary one of trying to soothe or coax it into good humour. At the same time there is wisdom in addressing an angry child in tones of grave disapproval, since, even when it is too young to understand the meaning of reproof, it is not too young to form an association between passionate outbursts and reproving intonations; and this is a first step towards the ultimate control of passion.

Among the early felt emotions we must not forget to include wonder and curiosity. "In the ordinary expression of the child," says Bain, "the distension of feature marking astonishment is very common," every little detail of the outer world seeming to produce upon it the effect, which in the adult is only occasioned by the extraordinary.

Curiosity shows itself the minute a child begins to take interest in other things besides its food; and when, though

it still carries everything to its mouth, it does so merely because the tongue is the finest, as well as the most exercised organ of touch. At this stage the child handles things, looks at them closely, pulls them to pieces, and so in playing instructs himself.

The emotion of affection is declared to rise early in life, though often it may not reveal itself in very palpable guise till the eleventh or twelfth month. Professor Ferri states that his little girl, when four months old, was rendered quite restless by her mother's absence, and that happening to catch sight of a gown her mother usually wore, she made every effort to get near it, and when it was brought within her reach, clutched at it and squeezed it with vehemence. Darwin's child at five months old plainly showed his wishes to go to his nurse. The likings of the child, in fact, are enlisted by those persons and things that procure it pleasurable sensations. Thus we find that it likes animals better than inanimate objects, because their movements, cries, colouring, and contact afford varied and intense satisfaction to its eye, ear, and sense of touch.

The consideration of the æsthetic emotions, and the means to be taken for cultivating these, must be reserved for a future article. A. M. H. B.

THE UNIVERSE OF SUNS.

By Richard A. Proctor.

(*Continued from page* 58.)

In accordance with the sound principles he had enunciated (see p. 57) Sir W. Herschel proceeded, in 1785, to develop his ideas of the universe, noting that for this purpose "it will be best to take the subject from a point of view at a considerable distance both of space and of time." I would invite the reader's special attention to this preliminary matter—absolutely omitted, so far as I am aware, from every published account of Herschel's views, and yet absolutely essential to their adequate interpretation.

"Let us suppose, then," he says, "numberless stars of various sizes, scattered over an indefinite portion of space in such a manner as to be almost equally distributed throughout the whole. The laws of attraction, which no doubt extend to the remotest regions of the fixed stars, will operate in such a manner as most probably to produce the following remarkable effects."

"*Form* I.—In the first place, since we have supposed the stars to be of various sizes, it will frequently happen that a star being considerably larger than its neighbouring ones, will attract them more than they will be attracted by others that are immediately round them; by which means they will be in turn, as it were, condensed about a centre; or, in other words, form themselves into a cluster of stars of almost a globular figure, more or less regularly so, according to the size and original distance of the surrounding stars.

"*Form* II.—The next case, which will also happen almost as frequently as the former, is where a few stars, though not superior in size to the rest, may chance to be rather nearer each other than the surrounding ones; for here also will be formed a prevailing attraction in the combined centre of gravity of them all, which will occasion the neighbouring stars to draw together, not indeed so as to form a regular or globular figure, but however in such a manner as to be condensed towards the common centre of gravity of the whole irregular cluster. And this construction admits of the utmost variety of shapes, according to the number and situation of the stars which first gave rise to the condensation of the rest.

"*Form* III.—From the composition and repeated conjunction of both the foregoing forms, a third may be derived, when many large stars, or combined small ones, are situated in long-extended, regular, or crooked rows, hooks, or branches; for they will also draw the surrounding ones, so as to produce figures of condensed stars; coarsely similar to the former which gave rise to these condensations.

"*Form* IV.—We may likewise admit of still more extensive combinations; when, at the same time that a cluster of stars is forming in one part of space, there may be another collecting in a different, but perhaps not far distant quarter, which may occasion a mutual approach towards their common centre of gravity.

"V.—In the last place, as a natural consequence of the former cases, there will be formed great cavities or vacancies by the retreat of the stars towards the various centres which attract them.

"So that upon the whole there is evidently a field of the greatest variety for the mutual and combined attractions of the heavenly bodies to exert themselves in."

Herschel then considers the objection that during the progress of the condensations he had described, there would be repeated catastrophes, caused by the shock of star against star and cluster against cluster. He shows that as regards the several clusters, "the indefinite extent of the sidereal heavens must produce a balance which will effectually secure all the great parts of the whole from approaching to each other." And as respects the several clusters, the particular stars may be saved from collision by the action of original projectile forces, which Herschel "had not intended to exclude," when, "by way of rendering the case more simple he considered the stars as originally at rest." "The admission of such forces will prove such a barrier," he remarks, "against the seeming destructive power of attraction as to secure from it all the stars belonging to a cluster,—if not for ever, at least for millions of ages. Besides," he adds, "we ought perhaps to look upon such clusters, and the destruction of now and then a star in some thousands of ages, as perhaps the very means by which the whole is preserved and renewed. These clusters may be the *laboratories* of the universe, if I may so express myself, wherein the most salutary remedies for the decay of the whole are prepared."

Herschel then considers the position of the terrestrial observer in his "own retired station, in one of the planets attending a star." He shows that to such an observer, placed in a much extended stratum or branching cluster of millions of stars, such as may fall under *Form III.* of nebulæ considered above, the following appearances will be presented:—To the naked eye "the heavens will not only be richly scattered over with brilliant constellations, but a shining zone or Milky Way will be perceived to surround the whole sphere of the heavens, owing to the combined light of those stars which are too small—that is, too remote—to be seen. Our observer's sight will be so confined, that he will imagine this single collection of stars, of which he does not even perceive the thousandth part, to be the whole contents of the heavens. Allowing him now the use of a common telescope he begins to suspect that all the milkiness of the bright path which surrounds the sphere may be owing to stars. He perceives a few clusters of them in various parts of the heavens, and finds also that there are a kind of nebulous patches; but still his views are not extended so far as to reach to the end of the stratum in which he is situated, so that he looks upon these patches as belonging to that system which to him seems to comprehend every celestial

object. He now increases his power of vision, and applying himself to a close observation, finds that the Milky Way is, indeed, no other than a collection of very small stars, He perceives that those objects which have been called nebulæ are evidently nothing but clusters of stars. He finds their number increase upon him, and when he resolves one nebula into stars he discovers ten new ones which he cannot resolve. He then forms the idea of immense strata of fixed stars, of clusters of stars, and of nebulæ*; till, going on with such interesting observations, he now perceives that all these appearances must naturally arise from the confined situation in which we are now placed. *Confined* it may justly be called, though in no less a space than what before appeared to be the whole region of the fixed stars; but which now has assumed the shape of a crookedly-branching nebula; not, indeed, one of the least, but perhaps very far from being the most considerable of those numberless clusters that enter into the construction of the heavens."

Noticing that our star-system is here described as of the *form* III., and that systems of *form* III. are made up of clusters and nebulæ of *form* I. and II., it will be inferred that by the clusters and nebulæ of the preceding paragraph Herschel signifies component parts of our stellar system. This is further shown by the sentence following almost immediately after the paragraph above cited. "It will appear," says Herschel, "that many hundreds of nebulæ *of the first and second forms*" (the italics are mine) are actually to be seen in the heavens, and their places will hereafter be pointed out. Many *of the third form* will be described,"—he actually describes ten such nebulæ, speaking of them as external Milky Ways,—"and instances of the fourth related. A few of the cavities mentioned in the fifth will be particularised, though many more have already been observed; so that upon the whole, I believe, it will be found that the foregoing theoretical view, with all its consequential appearances as seen by an eye enclosed in one of the nebulæ, is no more than a drawing from nature, wherein the features of the original have been closely copied; and I hope the resemblance will not be called a bad one, when it shall be considered how very limited must be the pencil of an inhabitant of so small and retired a portion of an indefinite system, in attempting the picture of so unbounded an extent."

THE MORALITY OF HAPPINESS.

By Thomas Foster.

SELF *VERSUS* OTHERS.

(*Continued from page* 37.)

A MAN'S power of increasing happiness depends both directly and indirectly on his fitness for the occupations of his life. Directly, because if unfit, whether through ill-health or inaptitude, he works with pain instead of pleasure, and because he gives less satisfaction or causes actual annoyance to those for whom his occupations, whatsoever they may be, are pursued. Indirectly, because as a result of work pursued under such conditions he suffers in temper and quality as a member of the body social. Hence all such care of self as is shown by attention to bodily health, by the careful culture of personal good qualities, by just apportionment of time to personal requirements, and so forth, may be regarded as of the nature of duty. In such degree as pleasure, recreation, change of scene, quiet, and the like, are necessary for the maintenance or improvement of the health, the care to secure these, so far from being held to be a concession to self, should be esteemed a most important point in "the whole duty of man."

A narrow view of duty to others may direct attention to what lies near at hand. Just as the savage consumes, to satisfy the hunger of a day, seed which should have been devoted to provide for many days in the future which lies beyond his ken, so the man who has no thought but of what lies near at hand, is apt to sacrifice health, strength, and fitness for work from which great and long-lasting benefits might have been reaped, to obtain painfully and uncomfortably much smaller results. By overwork and self-sacrifice — self-devotion if you will — a man may in a few years effect much material good to those around him,—perhaps more than in the time he could have effected by a wiser apportionment of his work and strength. But at the end of a much shorter period of work than he could have accomplished with ease and pleasantness, ere a tithe perhaps of the good he was really competent to do, has been effected, his health breaks down, his strength fails him, he can no longer do the good he wanted so much to do. Nay worse, life not only becomes a burden to him but he becomes a burden to others. A wise and thoughtful care of self would have avoided this. Such care of self then, even if regarded from the point of view which should be taken by the rest, is simply far-sighted regard for others.

Perhaps the simplest way of testing the matter is by considering what would happen if all or many of the members of a community followed a course which is commonly spoken of as if it were meritorious. It is manifest that a community chiefly composed of persons who neglecting self broke down their health and strength in exhausting efforts to advance the well-being of others would be a community constantly burdened by fresh accessions of worn out and used up members,—including eventually most of those who had been most anxious to serve their fellows.

But the question becomes still more serious when the known facts of heredity are taken into account. The evil effects of self-neglect, whether in the form of overwork, or asceticism, or avoidance of all such pleasurable emotions as lighten the toils and worries of life, or in other ways, affect posterity as well as the individual life. Ill-health and weakness are transmitted to children and to children's children through many generations. It is not going too far to say that on the average more misery is wrought and to a much greater number by neglect of self than can be matched by any amount of benefit conferred during life, still less by such benefit as directly arises from self-sacrifice. A man shall work day after day beyond his strength for ten years, and by such excess of activity shall perhaps accumulate at the expense of a ruined constitution what may confer a certain amount of happiness on several persons, or keep discomfort from them. Probably with better advised efforts during that time more real good might have been conferred on those same persons, for man does not live by bread alone; and certainly in the long run even of a single ordinary life much more good may be done by combining zeal for others with due regard for the welfare of self. But when we consider the multiplied misery inherited by the offspring of weak, sickly, and

* It is an important point to determine whether Herschel here means (i) the idea of immense strata,—composed of fixed stars, clusters, and nebulæ, or (ii) the idea of immense stellar strata, star-clusters, and nebulæ. The sentence will unfortunately bear either interpretation. Commentators seem usually to have regarded the second as Herschel's meaning, supposing the clusters and nebulæ to be something external to the Milky Way. Even Sir J. Herschel has adopted this interpretation. The context, as well as sequent remarks of Sir W. Herschel's show, however, that the first reading expresses his real meaning.

The Zodiacal Sign for February, with the paths of Mars and Jupiter in 1884.

gloomy parents, we see that even though on the whole there had been during life a balance in favour of happiness conferred, this—more than outweighed even in the first generation—would be many hundred times outweighed in the long run.

(To be continued.)

*** We feel each week more and more the pressure on our space, and are at length tempted to yield to those who have begged us to increase our size to 32 pages, or our matter by more than one half, and our price to threepence. Numbers of subjects and illustrations wait for want of room—and much time is occupied each week in cutting and contriving for space; while yet each week we run the risk of offending valued contributors and correspondents by keeping out or keeping back matter of great interest and value. We should be glad to be able to form an idea as to the views of readers on this point. It is idle, of course, to suggest (as many who take no interest in special subjects have done) that this or that subject should be omitted: on this point we have gauged the *average* opinion of our readers, which must guide us in the matter.

The Index to Vol. IV., Knowledge, is now ready, price 2d.; post-free, 2½d. The Volume also is just published comprising numbers from July to December, 1883, price 7s. 6d. Office: 74 to 76, Great Queen-street, London, W.C.

Fourpence each will be paid for copies of No. 33, Knowledge. —Apply or address, Publishers, 75, Great Queen-street, London, W.C.

THE NIGHT SIGN FOR FEBRUARY.

We give this week that sign of the zodiac, to wit Leo, which is now dominant in the midst of night, and the paths therein of Mars, (from November last to Midsummer) and Jupiter. The constellations now occupying this sign where once Leo reigned supreme are Cancer and the fore-part of the Lion. Mars just now is not far from the position referred to by Tennyson (we mean the Poet Laureate not the new law-maker) so poetically in Maud. We would recommend the use of a tint of red over the track of Mars, and of blue over the track of Jupiter, so that they will interfere less with the star-groupings. Names, letters, &c., can be similarly tinted with advantage. Next week we shall give the Day Sign, namely Aquarius, (the constellation Capricornus) and show the sun's path from day to day along that sign.

MARS IN OPPOSITION.

By Richard A. Proctor.

The Night-sky Zodiacal Map given above shows the loop traced out by Mars during the opposition of 1884, that is during that part of his motion around his orbit when he and the sun are on opposite sides of the earth.

Fig. 1 illustrates exactly to scale the motion of the earth and Mars along the parts of their respective paths

which they traverse from February 1st to May 11th. The positions of the two planets are shown at intervals of ten days, from February 1st the day of opposition (erroneously

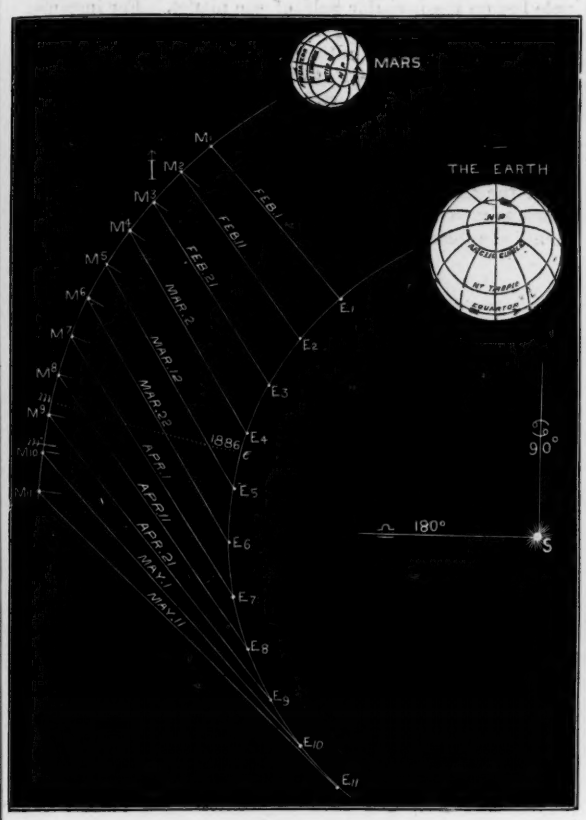


Fig. 1.

given January 31 in some almanacs*), to May 11. The planet as viewed from the earth appears stationary on March 13 (7 a.m.) or more correctly ceases then to retrograde, and begins anon to advance in the direction of the Zodiacal signs. The near parallelism of the lines connecting the planet on March 2, March 12, and March 22 shows why the planet seems no longer to retrograde. On April 27th the planet is seen again in nearly the same direction as on February 1st. Compare chart (Fig. 1), and also the looped paths of Mars (with corresponding dates) pictured at p. 8. The loop in the Zodiacal chart is in fact a perspective view of the loop shown on p. 8.

The projections of Mars and the earth in Fig. 1 are on a somewhat larger scale than the orbits,—in fact *exactly five thousand times* larger. The orbits are on a scale of fifty millions of miles to the inch; but the projections of the globes of Mars and the earth are on a scale of only 10,000 miles to the inch. On the same scale the sun would be nearly five yards in diameter; but I thought it would be inconvenient to show him on that scale in these columns.

Where the little arrow-headed line is shown Mars attains his greatest distance north of the ecliptic; at m he is in aphelion, at m' occurs the midsummer of his northern hemisphere.

The general reader but still more the student of Mars with the telescope may be interested by the following simple method for ascertaining the exact position of the polar axis and equator of Mars (as observed from the earth) when the right ascension and declination are known (these are given at convenient intervals in Whitaker's Almanac).*

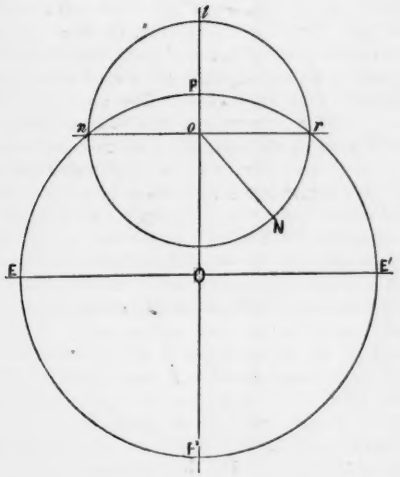


Fig. 2.

First make the construction in Fig. 2,—good for every case during the next half century or so. It explains itself:—P r, P n, each $= 39\frac{1}{2}°$ (=I of the formulæ); r N $= 47\frac{1}{2}°$ (=N of the formulæ).

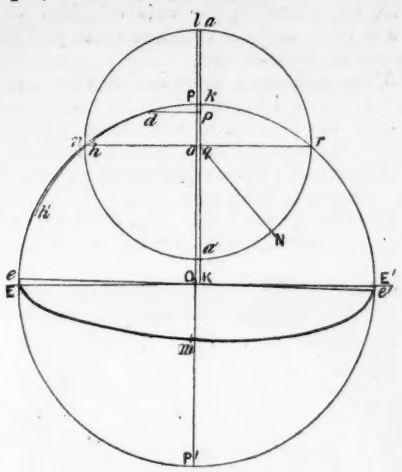


Fig. 3.

Suppose you want the axial aspect of Mars for Feb. 1.

Take (with a protractor) arc N a (Fig. 3)=Mars's right ascension 136° (9h. 4m.), and draw $a\,q$ K, sq. to $n\,q\,r$, O E O′; describe arc $k\,h$ about centre K to meet $n\,r$ in h. Take with a protractor arc $h\,d$ = Mars's north declination 21° 32′; and draw $d\,p$, sq. to k K.

* In Astronomical time Jan. 31, 23 h., which in civil time means Feb. 1, 11 a.m.

* The demonstration of the method of construction above given will be found somewhere in the *Monthly Notices of the Astronomical Society*, to which I sent it in the long past time when I was weak enough to waste time that way. I remember Herr Marth who still yields to a similar foible, saying to me after I had read my paper, "My dear Mr. Proctor, I tell them what is the position of the axis of Mars from day to day and *they won't use that*; do you suppose they will be at the pains to make a construction to find out for themselves what they don't care for when it is given them?" I wonder whether he was right.

Then p is the position of the north pole of Mars on his face P E P′ E′ (where P O P′ represents the meridian), and $d\,p = O\,m$, the apparent distance of the middle point of Mars's equator from the centre of his disc.

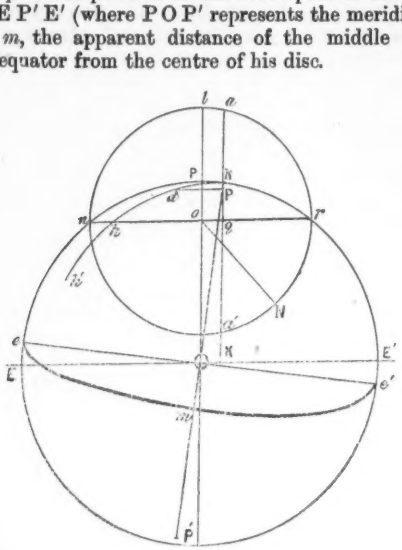


Fig. 4.

Fig. 4 gives the corresponding construction for March 13 when Mars reaches his stationary point. From Fig. 1 it will be inferred that the equator is at this time a little less open. About the end of April the planet's pose is nearly the same as on Feb. 1. A few days later, or more exactly on May 10, the planet's polar axis coincides with the meridian, and after that the visible or north pole passes to the left or east of the meridian.

In Fig. 5, the position of Mars as shown in an inverting telescope on February 1 is presented. To make such a construction after the position of the visible pole and the opening-out of the equator have been determined is easy enough. But presently in carrying out my plan for a series of mapping papers I shall give simple instructions for making a projection of this kind. Fig. 5 will serve for any time during the present opposition; for, as will be seen by

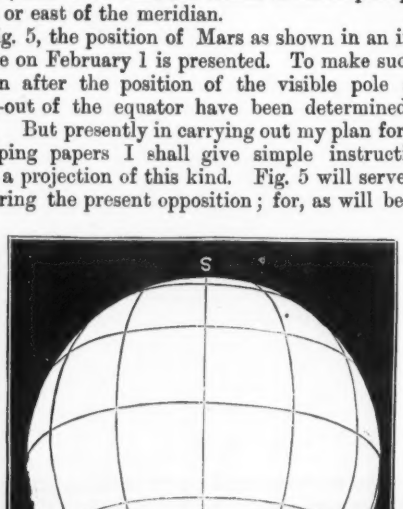


Fig. 5.

comparing Figs. 3 and 4, the opening of the Martian equator varies little during the next few months. The slant to the meridian attains it maximum, as shown in Fig. 4, about March 13.

I may remark that the above construction, including the constant part shown in Fig. 2, applies at all times; but it is to be noted that if the point a falls on $n\,N\,r$, the north pole lies on the invisible half of the planet. For instance, if a came as at a' in Figs. 3 and 4, the north pole would lie somewhere on $k\,g$, but on the concavity instead of the convexity of the sphere, P E P′ E′. Thus if the construction gave the point p, then p' such that $O\,p' = O\,p$ would be the position of the visible pole.

Declinations must be measured from h towards k in every case, whether northerly or southerly.

In the next few weeks, I propose, if I can possibly get space, to give some pictures and charts of Mars, illustrating points of interest in this miniature of our earth.

TRYING TRICYCLES.

By John Browning,

Chairman of the London Tricycle Club.

THOUGH I wrote my title for this article without a thought of jesting, I fear my readers will think me guilty of attempting a pun before they have read many lines further. During the last three years I have tried a great many rear-steering tricycles, because I considered that they were being unduly neglected in favour of front-steerers—an opinion which the success of the "Rover" has confirmed.

On one of the most original of these rear-steerers, I started on a fine evening in June, running down a steep hill from Upper Norwood towards Anerley. Before long my progress was checked by traffic; and, as the machine was provided with ratchets, so that I could not back-pedal, I was compelled to apply the break, which was of the spoon variety, and acted on the tyres of both wheels. The instant I did so the machine turned round at right angles and ran across the road full tilt, face forward, into a brick wall. The wall was only very little injured, and the machine did not suffer much by this deviation of ours from the straight way, but I could not forget the circumstance for a long while myself, though I wished to. I had several reasons for recollecting it.

Now the cause of this accident was that one of the spoon-brakes skidded the wheel to which it was applied much stronger than the other; that wheel was checked, but the other ran on, and so turned the machine half-round, with the result I have described.

After having the spoons altered so that they bit the wheels equally, I went out on one of our club runs with the machine.

During the outward journey, in daylight, it behaved tolerably well, only betraying occasionally a fondness for kerbstones, ditches (dry or wet), posts, and cottage door-steps, which was trying, and kept the rider in a state of pleasurable excitement as to where he should find himself the next minute.

This uncertain behaviour was caused by the back-bone of the machine being too short and the hind steering-wheel too small, so that it did not answer the helm readily.

But if on the outward journey the machine evinced some desire to run away with its rider, when homeward bound it made handsome compensation by jibbing, going occasionally by fits and starts, and sometimes refusing to travel at all. I became the rear-guard of the run, and as the riders of the London Club are far too gentlemanly to run away from a member in difficulties, the return journey was trying to them as well as to myself.

The cause of this misbehaviour was that the nuts which

clasp the ball-bearings were too loose, and being screwed on from the under side, instead of the upper, as they should have been, permitted the opening of the journals, and this escaped observation in the dusk. The balls ran up on to the sides of the holes in the cages and jammed themselves, and then fell back with each hard jerk—or, as it is called, "kick"—on the pedal, and so allowed the machine to progress spasmodically.

The next day I sent the machine back to the maker, and he shortly returned me another.

Finding the faults in the former machine had been amended, I started out on the new mount with some confidence for a ride through Sydenham and Beckenham and on to Keston and Downe, till lately the dwelling-place of Darwin.

The machine seemed to run very well until, on descending West Hill, Sydenham, finding my progress impeded by the traffic, I attempted to apply the brake, which was certainly right when I started. To my consternation, I found it had no action on the machine. I was running at the rate of ten miles an hour, and I had a steep descent of full a quarter of a mile in front of me, with many vehicles in the road, and I was without any power of back-pedalling. There was no time for hesitation. I clapped the palms of my hands on to the rubber tires of the wheels, and, steering and checking the machine by these means, I brought myself up safely in a few minutes. As the skin was off my hands before I could stop, and my hands were bleeding, those few moments *were* trying.

Now, the cause of the machine running away in this instance was very simple. The break lever was secured to the rod to which the two spoons were attached by a quick tapered pin. This pin, with a thoughtlessness almost criminal, had been put into its place with the large end downwards, the jarring of the machine had loosened the pin, and it had fallen out on the road.

Had the pin been fitted with the largest end upwards this mishap would not have been possible.

Brake accidents should be provided against most carefully, so I will relate two others which befell me.

I was trying a new small front-steerer for the first time, and had more than the usual amount of difficulty in adjusting the seat to the right height. Having got the seat right at last, I pedalled away merrily, and presently turned over the brow of the short, steep hill known as the Robin Hood Hill. Seeing a furniture-van drawn right across the hill, I attempted to apply my brake, but found it had no effect.

I had the power of back-pedalling, but at the pace I was running on such a steep descent it would not have been possible for me to have stopped before I reached the furniture-van. In an instant I recollected that being on a very small-wheeled machine I could make my heels foul the axle, *if I wished to*, so I slipped my feet back until the points of my toes fell into the pedals, and my heels jammed against the axle at each revolution. In three or four revolutions I brought the machine up so that I was able to turn it round on the hill-side, and I ran it against the stone kerb, and stopped it just before it reached the van. I was naturally anxious not to damage the van if I could possibly avoid it.

I had to rest a little while before I proceeded on my way, for the time my toes were pinched in the pedals and my heels bruised by the axle had been trying.

How came this trouble to happen? Well, in this way:—Every time the height of the seat was altered the brake required re-adjusting. For the first time or two I recollected this, but on the last occasion I must have forgotten it, and started with my band-brake loose.

I have never forgotten to adjust it since.

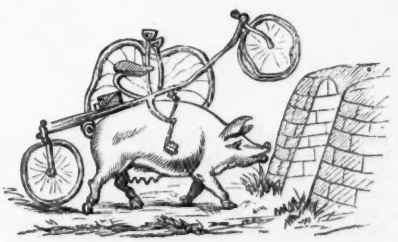
The last brake accident I have to recount befell me in this wise:—

I had got a new, small, extra light front-steering machine, and on the first attempt to bring it up by means of the break, when running down a slight incline I thought it inefficient. Intent only on testing the action of the break I got up speed a bit on the level, and then by back-pedalling reduced it to certainly less than six miles an hour. Having done this, I applied the break sharply, and in an instant I was shot over the handles. That break was perfect—no doubt about it!

I managed to remount and stop the machine twice, but I was more battered than I thought for.

My lip and tongue were cut through, and both my knee-caps nearly cracked. I had to live on slops for one week, and drag about by the aid of a stick for another. Flights of stairs, which are generally a delight to me, became a torture. The whole of that fortnight was trying. I can trust my readers to draw the moral of this mistake for themselves.

The last account of testing a tricycle which I shall relate now happened to my friend Mr. Salmon, who was riding his celebrated small machine, the "Shadow," made by Hirst, of Croydon, which weighs only 46 lb., down to Brighton to attend the council meeting of the Tricycle Union. Having to stop to meet some members of the Brighton Cyclists' Club, who were riding out to meet him, he put up at an inn about nine miles from Brighton. For safety he put his small tricycle into a narrow passage, which he selected as a *cul-de-sac*. But there was a pig-stye at the end of that passage, and the old sow, requiring to go into her home shortly afterwards, found the machine in her way. She tried to get under it, and as she did so the teeth of the rat-trap racing pedals stuck into her sides, which both frightened and hurt her, so she backed out of the passage, carrying the tricycle aloft, and dashed about the inn-yard, until she was relieved of it, by which time it was a perfect wreck, as depicted.



The engraving, of what might be termed the trial of Sow *versus* Shadow, is from a sketch made by Mr. Schultz, a member of the Brighton Cycling Club, who was an eye-witness of the whole of the proceedings, and assisted at the rescue of the wreck of the "Shadow."

I will conclude with the earnest wish that my readers may not have found this article too trying.

MESSRS. STARLEY & SUTTON ask us to state that they have registered the name and design of their new tricycle, the "Rover."

UNDERGROUND WIRES IN FRANCE. — According to a statement just prepared, it appears that the French Government have determined, in addition to their extensive system of underground telegraph wires recently laid, to lay a further length of 7,296 kilomètres (rather over 4,530 miles) of cables, the cost of which is estimated at 54,000,000 francs, or £2,160,000.

Reviews.

OPTICS WITHOUT MATHEMATICS.*

THIS work contrasts rather strangely with Sir Edmund Beckett's justly celebrated work "Astronomy without Mathematics." The title of the latter work is somewhat deceptive; readers expect an account of matters astronomical which shall be easily read and followed: they find a treatise which needs very close attention and cannot all (we imagine) be understood without much of that faculty which is required in mathematical studies, even if much acquired mathematical knowledge is not required. In Mr. Webb's work many would expect to find the laws of optics explained without mathematics; but this is not done,—for a very good reason; it is not possible. Mr. Webb describes and explains his descriptions; but he does not explain what he describes. It is however of far more importance to have—as here—correct and simple descriptions, than to have, as in so many treatises on optics, inexact yet complex attempts at explanation. Here and there Mr. Webb's account is open to a little question, and some of the illustrations certainly require improvement. For instance, the illustration of the rainbow at p. 89 must prove perplexing to the learner, the sun being put almost vertically over the observer's eye, and the angle between the right lines to the rainbow and those to the sun being far too small.

As an illustration equally of what Mr. Webb does and of what he (wisely) leaves unattempted, we give his account of polarisation:—

Polarisation,—Much of the light around us is more or less polarised without our being aware of it. The name seems to have been taken from magnetism or electricity; but it is not particularly suitable, and it is better not to think about poles, but to try to suppose, that is for our present purpose, that every ray of natural light consists of undulations crossing each other in every possible direction, and that when polarised they are all turned in two directions at right angles, something in this way:—

How this comes to pass is quite beyond our comprehension, and fortunately beside our purpose; but so it is that all polished bodies, except metals, polarise the light that they reflect, provided it is incident at a certain angle, called the *polarising angle*, which is different in different substances; the amount of polarisation diminishing in proportion as that angle is departed from: and so again all doubly refracting crystals polarise their two rays, but always in planes at right angles to each other, the *plane of polarisation* being that which passes through the original and the polarised ray. Now, this being understood, that in certain cases, both of reflection and refraction, all the undulations can be turned two ways at right angles, it also happens, you will not ask me how, that there is something corresponding in the structure of many bodies that will only receive them in those ways: so that when polarised light falls on such surfaces it will either pass freely, or be stopped and extinguished, according as the direction of its undulations agrees or disagrees with the optical structure of the body,† the extinction being most complete when these are at right angles, and more or less partial in intermediate positions. There are several contrivances to show this very curious effect, called *Polariscopes*; the most simple is the *Tourmaline*, a doubly refracting crystal found chiefly in Ceylon, which would be best of all but for its being coloured. If two thin slices of this, cut with reference to its optical property, are so set close together that one may be turned round in front of the other, all the light will pass through if their optical structure lies the same way, or all be quenched if the second is turned so as to cross the first at right angles; a partial extinction taking place at intermediate positions. This is the case of ordinary light, which gets polarised in passing through the first plate, and then transmitted or stopped by the agreeing or disagreeing polarising power of the second: of course, if rays have been already polarised elsewhere, one slice of tourmaline that can be turned round will answer the same purpose. In such experiments we call the first crystal or surface the *polariser*, the second the *analyser*. The use of an analyser will show how much polarised light surrounds us; if we only get it at the right angle we shall find polarised light reflected by glass, water, polished furniture, varnished pictures, shining leaves, and many other things, but not metals, for a reason that it would be very difficult for us to understand. Many media have the power of changing or "rotating" the plane of polarisation; and thus differences are sometimes shown in their nature that would not otherwise be detected. An instrument called a "saccharometer" is used to ascertain the genuineness of sugar; the juice of the cane and that of the grape turning the plane in opposite directions. A more surprising and mysterious fact was discovered by Faraday—that the plane of polarisation is shifted by the influence of a powerful magnet.

* By the Rev. Thos. W. Webb, M.A. Published by the Society for Promoting Christian Knowledge. (London and New York.)

† We must always bear in mind that the direction of a ray, as it passes onward in its course, is quite a distinct thing from the direction of the undulations which form light, and are always at right angles to the path of the ray.

NOTES ON BOOKS.

County Atlas, of England and Wales, with all the Railways and Coach Roads (J. Heywood, Manchester and London). A splendid shillingsworth, each county in its alphabetical place, so that one can turn at once to the county one wants. A most convenient travelling companion.—Chemical Analysis, by *A. H. Scott-White*. A useful little treatise, serving as a convenient text-book for examinations in which a practical knowledge of chemical analysis is required.—History Readers (Moffatt & Paige, London). Our young folks are still taught history too much in the style which of old was thought the only orthodox one; but in the series of historical readings published by Messrs. Moffatt & Paige we see the influence of those historians who in recent times have tried to show that history means, or should mean, something more than a record of rulers, piratical or otherwise, who obtained dominion or territory by means more or less nefarious; and that even battles, sieges, murders, and the like, are not *very* much more important than the progress of art, literature, commerce, and science. The more fanciful illustrations in these books, such as Boadicea addressing the Britons (a young lady of the nineteenth century who by some accident comes to have a spear in her left hand), King Alfred in his study, and so forth, would have been better omitted; they are untruthful; but the pictures of places, costume, &c., are useful and good.—First Lessons on Health, by *J. Berners* (Macmillan & Co., London). A useful series of simple lessons in sanitary matters, given originally to a girls' class in a national school. Light in style and tone, but most important in substance.—Solar Physics and Earthquake Commotions applied to elucidate Locust Multiplication and Emigration, by *A. H. Swinton*. The Solar Physics Endowment folk should reward the author of this pamphlet. It is to be followed, we imagine, by a treatise showing, How, from the observed length of a ship at sea and the number of her masts, to infer the name of the captain and whether the second mate has had the measles.—Whence? What? Where? by *Dr. Jas. R. Nichols* (Trübner & Co., London). A bright and suggestive discussion of the origin, nature, and destiny of the human race; but the best answer to our author's title-questions, seems to us to be "*Here, Thus, Now.*"—Bookkeeping no Mystery, by *An Experienced Bookkeeper* (Crosby, Lockwood, & Co., London). Bookkeeping as it was previously taught seemed like a rather involved sort

of algebra, with rules technically worded and made elaborately mysterious. In this little book bookkeeping is made interesting — almost entertaining. It is a really useful work.—Copy-Books. An excellent and very cheap series published by Moffatt & Paige, London. — Comic Poetry, English and American (W. Kent & Co., London). A miscellaneous collection of humorous poems, pleasing as combining the modern fun of the "Bab Ballads" and Bret Harte with Tom Hood (earlier poems), Cowper, Peter Pindar, Oliver Goldsmith, and Prior; and be it noticed that Prior's English sounds as modern as Mr. Gilbert's,—all but the rhyme "creature" and "nature," which reminds us how our Irish cousins got their pronunciation. Many will be pleased to find here three of Bayley's songs, but Bayley was not quite so funny as the last generation thought him when they sang his songs,—his words want music with them. "Out" even approaches stupidity in parts; but how funny it sounded as a song!—Elementary Conic Sections. Part I. By *H. G. Willis M.A.* (Bell & Co., London and Cambridge). A useful treatise on the conic sections treated geometrically, and including well-arranged sections on Harmonic Ratio, Poles and Polars, Reciprocation and Projection, conical and orthogonal. We are particularly pleased with the way in which the corresponding properties of the parabola, ellipse, and hyperbola are treated together, not left to be associated by the student while he is dealing with the curves separately.—Magnetic Survey of North-west Canada. By *Lieut.* (now *General Sir J. H.*) *Lefroy* (Longmans & Co., London). This diary of the magnetic survey of the north-western portion of the region of Canada is a work of great value and importance. It indicates features of singular interest which are not found in Sir Edward Sabine's Contributions to Terrestrial Magnetism. The work is of special value, because it must be from observations in this very region that the movements of the northern magnetic pole will for the next century or so be chiefly determined. After that time the north-eastern parts of the Asiatic continent will be the chief region of observation for the purpose. Every one who desires to understand the data of the complicated problem of terrestrial magnetism, should master the evidence gathered together in this important contribution to the work of magnetic survey. — Natural Philosophy. Translated from *M. Ganot's Cours Élémentaire de Physique*, by *Prof. Atkinson* (5th Edition. Longmans & Co.: London.) This may be regarded as an abridgment of Prof. Atkinson's translation of *Ganot's Éléments de Physique*. It is the most trustworthy and withal the most interesting work of the kind known to us. Written by one well versed in the subjects dealt with, and translated ably and thoughtfully by a skilful physicist, it is free throughout from such blunders as disfigure Guillemin's "Forces of Nature," and other as pretentious volumes.

The World's Production of Iron and Steel.—In 1876, the total amount of pig-iron produced was about 14 million tons; in 1882 it was over 20 million tons, being an increase of 43 per cent. in six years. The production of steel in 1877 was under 2½ million tons; in 1882 it was over 6 million tons, showing an increase of 150 per cent. in five years. In 1876, the production of coal was about 280 million tons; in 1882 it had risen to about 375 millions, an increase of 34 per cent. in six years. In 1882, Great Britain produced 8,493,237 tons of pig-iron, 2,259,649 tons of steel, and 158,499,977 tons of coal; while the United States turned out 4,623,323 tons of pig-iron, 1,736,692 tons of steel, and about 83,500,000 tons of coal, but the comparative increase in American production has been much more rapid than that of British.

THE FACE OF THE SKY.

From February 1 to February 15.

By F.R.A.S.

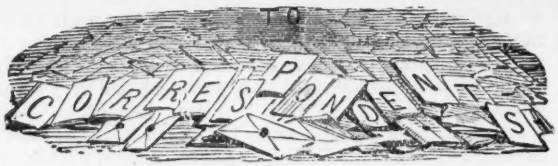
Attaining now daily a greater meridian altitude, and being, *pro tanto*, more favourably situated for the observer, the Sun should be examined whenever he is visible for spots and faculæ. Map II. of "The Stars in their Seasons" gives the present aspect of the night sky. Minima of Algol (Map I.) will occur on Feb. 2, 9 min. after midnight; on the 5th at 8h. 58m. p.m.; and at 5h. 47m. on the evening of the 8th. Mercury is very badly placed for the observer, being only visible, if at all, before sunrise. Venus is an evening star, and is daily coming into a better position for the observer. She is a striking object over the west-south-western part of the horizon after sunset. In the telescope she is still gibbous. The meaning of this word has been previously explained in these notes. As Mars comes into opposition to the sun at 11 o'clock to-night he is as well placed for the observer as he will be for a long time to come; and although his angular diameter (16″·6) falls lamentably short of that which he presented during the famous opposition of 1877, he is still a very remarkable and interesting telescopic object; all the superficial details to which we referred a fortnight ago (p. 46) being well marked with adequate optical power. He travels backward in Cancer from a point some 1° south of ξ in that constellation (Map III. of "The Stars in their Seasons"). Jupiter is still the most conspicuous object in the sky, where he may be observed all night long. He, like Mars, is travelling backwards in Cancer, into the blank region between Cancer and Gemini (Zodiacal Map, p. 40). The phenomena exhibited by his satellites before 1 a.m. are numerous and interesting during the next fortnight. This evening (the 1st) Satellite I. will be occulted at 5h. 40m., and reappear from eclipse on the opposide side of the planet at 8h. 16m. 4s. p.m. Satellite III. will be occulted at 10h. 58m. p.m. on the 2nd, but will not reappear from eclipse until nearly 4 o'clock the next morning. An occultation of Satellite II. will occur at 10h. 10m. p.m. on the 3rd. Its reappearance from eclipse at 1h. 46m. 28s. a.m. on the 4th. On the 5th, Satellite II. will pass off Jupiter's face at 7h. 8m. p.m., as will its shadow later, at 7h. 58m. The egress of the shadow of Satellite III. will occur at 6 o'clock in the evening of the 6th, and Satellite I. be occulted 58 minutes after midnight. On the 7th, Satellite I. will begin its transit over the planet's face at 10h. 17m. p.m.; followed by its shadow at 10h. 45m. The satellite will pass off at 12h. 37m. p.m.; its shadow at 1h. 5m. a.m. on the 8th. On the evening of the 8th, the shadow of Satellite IV. will enter on to Jupiter's limb (the satellite casting it having left Jupiter's opposite limb four minutes previously). Then Satellite I. will be occulted at 7h. 24m.; to re-appear from eclipse at 10h. 10m. 42s. p.m.; while at 10h. 21m. the shadow of Satellite IV. will quit Jupiter's disc. On the 9th, Satellite I. will pass off the planet's face at 7h. 3m. p.m.; as will its shadow at 7h. 34m. Satellite II. will be occulted 26m. after midnight on the 10th. On the 12th, the transit of Satellite I. will begin at 6h. 31m. p.m., as will that of its shadow at 7h. 40m. The satellite will leave Jupiter's opposite limb at 9h. 25m.; and its shadow at 10h. 34m. p.m. At 6h. 25m. p.m., on the 13th, the shadow of Satellite III. will begin its transit; Satellite III. itself passing off the face of the planet at 7h. 35m. The shadow will quit Jupiter's limb at 10h. p.m. On the 14th, Satellite I. will begin its transit 2m. after midnight, as will its shadow 38m. afterwards. Lastly, on the 15th, Satellite I. will be occulted at 9h. 9m. p.m.; to re-appear from eclipse at 12h. 5m. 28s. p.m. Saturn should now be looked at as soon after dark as convenient, as he souths about twenty minutes past seven in the evening on the 1st, and nearly an hour sooner by the 15th. He remains sensibly stationary just to the west of ε Tauri ("The Stars in their Seasons," Map I.); Uranus may be found about midnight, somewhere about half-way between β and η Virginis ("The Stars in their Seasons," Map V.); Neptune is now getting near the west, and is badly placed for the observer. The age of the moon to-day at noon is 4·3 days, and, quite obviously, she will be 18·3 days old at the same hour on the 15th. Occultations of stars are numerous during the coming fortnight. On February 4 the 6th mag. star, B.A.C. 1,119, will disappear at the moon's dark limb at 11h. 48m. p.m., at an angle of 171° from her vertex; and reappear at her bright limb at 12h. 34m. p.m., at an angle from her vertex of 280°. On February 5 δ^2 Tauri (a star of the 6th mag.) will disappear at the dark limb at 4h. 20m. p.m., at a vertical angle of 357°, to reappear at the bright limb at 4h. 44m. p.m., at an angle of 318° from the moon's vertex. A little later, at 4h. 56m. p.m., δ^3 Tauri, a 5th magnitude star, will disappear at the dark limb of the moon at an angle from her vertex of 105°. It will reappear at the bright limb, at a vertical angle of 223°, at 5h. 54m. p.m. On the 6th,

the 5½ mag. star, 119 Tauri, will disappear at the dark limb at 8h. 16m. p.m., at an angle of 95° from the vertex of the moon; to reappear at her bright limb at 9h. 31m. p.m., at a vertical angle of 283°. Afterwards, at 9h. 0m. p.m., the 6th mag. star, 120 Tauri, will disappear at the dark limb at an angle of 96° from the moon's vertex, reappearing at her bright limb at 10h. 13m. p.m., at an angle from her vertex of 299°. On the 8th, 68 Geminorum, a 5½ mag. star, will disappear at the dark limb of the moon at 10h. 10m. p.m., at an angle of 23° from her vertex. It will reappear at her bright limb at 10h. 55m. p.m., at a vertical angle of 322°. On the 9th, "B.A.C." 2,872, a star of the 6th mag., will disappear at the moon's dark limb at 11 minutes after midnight, at an angle of 160° from her vertex. It will reappear at 12h. 31m. p.m., at an angle from her vertex of 196°. Lastly, on the 11th, another 6th mag. star, 16 Sextantis, will disappear at the bright limb of the moon at 6h. 31m. p.m. at a vertical angle of 328°. It will reappear at her dark limb, at an angle of 283° from her vertex, at 6h. 53m. p.m. The moon is travelling through Pisces all day to-day and to-morrow, crossing the boundary into Aries at 1 a.m. on Feb. 3. She continues in Aries until 5 p.m. on the 4th, when she enters Taurus. Her passage through this constellation occupies her until 5 a.m. on the 7th, when she enters the extreme northerly portion of Orion. This takes her almost exactly 12 hours to cross, and at 5 p.m. she emerges into Gemini; which she quits at 7 a.m. on the 9th for Cancer. She leaves Cancer at 9h. p.m. on the 10th, and enters Leo, from which she descends into Sextans during the early afternoon of the 11th. She passes out of Sextans into Leo again about 3 p.m. on the 12th, finally quitting it for Virgo at 5 p.m. on the 13th. She is still travelling through this large constellation when our notes terminate.

When the Northern Pacific Railway was opened last July, the people at Vancouver's Island and Puget Sound came with all sorts of banners, including the Union Jack and the flags of Germany and other countries. Many of the flags bore suitable mottoes for the instruction of the party, and one of them was "Modesty is a great virtue, but you get on better without it."

Telephonic Communication between Moving Vessels.—The telephone has been successfully used in France to communicate between two vessels, one of which was towing the other. The wire was carried along one of the hawsers, and the circuit was completed through the copper on the bottom of the ships and the water. Conversation was carried on distinctly.

Luxotype.—We have been shown some specimens of luxotype, a process by which a printing block ready for use in newspapers or magazines can be obtained from paintings, photographs, natural objects, buildings, &c., without the aid of draughtsman or engraver! The process is not described, but a scrutiny of the engravings shows how the blocks have been produced; for the warp and weft of some gauze-like material (used either to intercept or to receive the light, in greater or less degree according to the quantity of light coming from the different parts of the original) can be clearly discerned. But be the process (patented) what it may, the results are marvellous. Some of the prints sent us compare favourably even with the fine wood-engravings which adorn *Harper's Magazine*, *Scribner's* (the *Century*, we would say), and now in Macmillan's *English Illustrated Magazine*. We do not know how the process compares in cost with the fine wood-engraving in these magazines. Possibly at present it may not be much cheaper; but it is certain to become so before long. One little criticism we would venture to make. Where buildings are represented, great care should be taken in suitably placing the lines of the gauze-like material above mentioned. On the otherwise fine view of the gateway of St. John's College, Cambridge, the slight slant of the lines where their distance apart is about that of the lines of brickwork, gives a curious slanting effect to the part of the first court (just over the passage to the second court) seen through the gateway.



"Let Knowledge grow from more to more."—Alfred Tennyson.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

All Editorial communications should be addressed to the Editor of Knowledge; *all Business communications to the* Publishers, *at the Office, 74, Great Queen-street, W.C.* If this is not attended to delays arise for which the Editor is not responsible.

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No communications are answered by post, even though stamped and directed envelope be enclosed.

PONS'S COMET.

[1104]—It may be well to correct the statement of "F.R.A.S." ("The Face of the Sky," page 46), that Pons's Comet is no longer visible. I saw it last evening between 6.30 and 7.30, and again to-night it is a beautiful object in my three-inch Tulley, verifying the correctness of the figure by "Senex" in your current number. Many readers may be glad to be reminded of Mr. Bradgate's note in No. 109, where he says:—"On January 30 the comet will be in Cetus, on February 13 in Sculptor, and after the latter date will be invisible in these latitudes," as, according to him, there is still a good fortnight in which to observe this interesting object.

Shrewsbury, Jan. 27, 1884. Martin J. Harding.

RED SKY-GLOW.

[1105]—On Dec. 23 I sent to Knowledge a letter recording two observations of red sky-glow in daylight, but as it did not appear, I concluded that editorial discretion had relegated it to the w.p.b. Captain Noble's remark in Knowledge of yesterday (Letter 1100), that "observations of the glow in actual sunlight are both interesting and important," has caused me to think that my letter has not reached you—owing, perhaps, to Christmas demoralisation at the P.O.,—and as I have on two occasions since then seen the glow in sunlight, it may be worth while to record my experience. Between 11 and 12 a.m. on Nov. 25 I was watching a big, low-lying black cloud passing across the sky, and as it came in front of the sun I noticed that the sky surrounding the cloud was of a livid purply red colour (my wife called the colour "crushed strawberry"). There was a good deal of ragged cumulus cloud (cirro-c) at the time, and the weather was unsettled, with a very low barometer (28·82 in.). At that time the "after-glow" had not been seen in Sheffield, but was visible that night for the first time. Again, at 2 p.m. on December 18, a cirro-cumulus cloud passing in front of the sun showed a "crushed strawberry"-coloured sky surrounding it. On this occasion the weather was fine, and the barometer high (30·34 in.). Like most other parts of the country, we had a dense fog here on Christmas-day, and at half-past four it became of a beautiful mauve colour. This I saw, with several friends, at my house on the outskirts of Sheffield, and, though the house was enveloped by the fog, I found, when I went out later on, that the fog only extended a few hundred yards further in a south-westerly direction. The last occasion on which I saw the "after-glow" here was on January 11, and it lasted an hour and a-half after sunset. On January 12 the sky was cloudy, and after sunset the clouds were suffused with a pink colour. Since then we have had many clear and golden sunsets, but no "after-glow."

This week the weather has been very wet and squally, and the sky has been overcast much of the time, but on Wednesday, Jan. 23, the cloud canopy broke up, revealing the sun with the sky near it of a red colour; and again on Thursday, Jan. 24, there were many bright intervals of sunshine, and the sky in the neighbourhood of the sun was always of the same red colour as that first seen on Nov. 25.

On the two first occasions that I saw the red sky glow in daylight it was only visible when a cloud was in front of the sun; but on Jan. 23 and 24 it was visible when there was no cloud near the sun, and the colour extended a considerable distance from the sun.

To-day the barometer in Sheffield has been lower than I ever before noticed it. At 9 o'clock this morning the reading was 29·09 in. and at 6 p.m. it had fallen to 28·27 in. From 6 to 10 to-night the weather has been bright and fine, with frequent and vivid flashes of lightning, but no thunder. The barometer readings are all corrected for temperature, and reduced to sea level.

Museum, Sheffield, *Jan.* 26. E. HOWARTH.

BLUE MOON.

[1106]—There is a very old Norfolk proverbial saying, once in a blue moon. Can it have had its origin in the actual and yet very infrequent observation of that phenomenon? Or is it a mere random shot at an illustration of rare events?

The moon here in November was of the intensest sapphire blue, the perfectly clear sky looking rather slaty. This morning at 6.30 there was a fine sky-glow, and so last week. It certainly appeared to come from aqueous vapour. CENTRE-NORFOLK.

Jan. 22, 1884.

THE SENSES IN INFANTS—BLUE MOON.

[1107]—I have read with much interest "A. M. H. B.'s" papers on "The Senses in Infants," and beg to forward a few facts in connection with the subject.

I have a little girl just three years old. Before she was a week old, she fixed her eyes on my face and smiled. Thinking it to be a mere accident, I asked the nurse to take particular notice of her, and she assured me, after a day or two, that there was no doubt in the case as she acted towards her in the same manner.

When a month old she evinced a decided preference for anything *blue*, seeming specially pleased with a little sister's blue dress.

On reading in KNOWLEDGE what is there said about the discrimination of colours by infants, I decided to test my little girl's powers. (It has been common with her to talk of colours by name since she was two years old, and even earlier.) I placed before her some skeins of wool—cuttings from which I enclose—and asked her to give me the *red* one, when she declared there was no red one; and on my calling her a dunce, and pointing to No. 1, averred that it was not red but *pink* (the absence of a pink probably led her into error). [But No. 1 is not red; it is almost exactly carmine lake, and carmine lake *diluted* is not far from pink.—R.P.] Being asked for orange she selected No. 2, and, asked for the best yellow, chose 3. In the absence of 2 [orange], she chooses 5 [brick yellow] as orange; and while 3 [strong yellow] is before her, calls 4 [pale yellow] white. She selects both 6 and 7 as green, but shows a decided preference for 6.

Allow me to express the great pleasure KNOWLEDGE has from its commencement, and still continues to afford me, and to wish you and it continued success. J. G. BRYANT.

A PLANETARY CURIOSITY.

[1108]—It is required to describe on our globe as large a circle as possible with these properties:—

1. That it contains more land than water.
2. The circumference to cross more land than water.
3. No stream to cross the circumference outward; but any number may enter from without.

Another problem is, instead of the largest such circle, the one whose entering streams drain the most land outside it.

E. L. G.

LADYBIRDS—POLARISATION OF LIGHT.

[1109]—In the paper on "Ladybirds" in a late number of KNOWLEDGE, a curious fact connected with these insects is not noticed, and perhaps not generally known. I have noticed that at the end of the year they are in the habit of collecting in small colonies of a dozen or so, and closing themselves up in leaves. At any rate, I have found this frequently in Hampshire. You see an apparently dead leaf rolled up, and stuck together at the edges on the brambles by the roadside, and on opening these they are found to contain a mass of living ladybirds, apparently hybernating.

There is one subject which, I think, has never been touched upon in KNOWLEDGE, and on which, I think, a popular treatise in plain words is much wanted, viz., "Polarisation of Light"—especially as applied to the microscope. Would you, or would some of your correspondents kindly undertake this? Polarising objects for the microscope are so very pretty and interesting for popular exhibition, and always excite questions as to the cause of the varied colours; but I must admit that I find it extremely difficult to satisfy such questions in the case of ladies and people not at all acquainted with the elements of optical science. F.R.C.S.

LETTERS RECEIVED (SUB-EDITOR).

H. DAVEY.—P. S. BAGGE.—J. W. B.—F. W. H.—W. N.—W. M. T. Do not know.—H. B.—C. T.—A. L.—I. C. M. A.—E. P.—SENEX.—H.—E. G.—E. D. G.—A. H.—B. G.—C. H. G.—SOLARIUM.—COSMOPOLITAN.—E. J. C.—P. AND S.—W. A.—W. T.—J. E. LUSH.—L. F. B.—W. O. D.—NAGGDRIS.—W. M. M.—J. D. L.—W. H. S. M.—STARCH.—C. CARUS WILSON.—E. G.—HALLYARDS.—E. H.—A. F. OSBORNE.—W. E. P.—A. E.—E. F. MACGEORGE.—AN INQUIRER.—W. A. P.—J. L. C.—J. M.—J. P. H. G.—J. P.—J. T.—C. T. D.—H. G. W. You have quite misunderstood D. M.'s problem.—J. P.—H. G. M. TOD.—W. G. S.—S. C. T.—VIGNOLES.—J. H. W. LAING.—H. G. B.—A. SPURLING.—C. W. KIND.—TYRO.—R. HODGSON.—J. F.—H. K. P.—F. M. D.—O. R. JONES.—G. E. C.—C. C.—ROSE.—C. R. T.—T. G. S.—H. N. S.—E. A. D.—E. W. P. Queries *re* Bunsen cell answered in article "Batteries, IX." Other questions have really not yet been dealt with, but deferred until the description of an alternating machine (probably the Ferranti) is given.

HY. CLARK—M. J. HARDING—"ONE FOR HIS NOB." How can dealer make "about 185," pegging and scoring from these hands?—NOVICE. The double track with dates on the left.—J. M. GLADSTONE. Have no knowledge about measuring timber, probably some practical detail is involved. Certainly content of a cylindrical body, girth 24 in., and length 10 ft. would be 12 in. × 3·82 in. × 120 in. = 3·2 cubic feet.—H. TINSON. You do not extend the problem to include "crib."—W. J. C. Thanks. Your suggestion in accordance with facts; but just now many correspondence columns crowded out for want of space. It will be well to observe the Zodiacal light carefully in the evening during next two months.—C. J. BROWN. Thanks; but your observation would not help to determine real path of meteor in space.

Our Whist Column.

BY "FIVE OF CLUBS."

W. H. COLLINS.—So far as trick-making in the suit is concerned, the lead of Ace, from Ace, Queen, two small ones, is about as good as the lead of a small one: from Ace, Queen, one small one, not quite so good, because with the shorter suit there is less chance of being ruffed. But in most cases, considering the play of the whole hand, the lead of the smallest is better. Not so much better but that the old-fashioned lead of Ace from Ace, Queen, two small ones may not be defended. What I think fairly turns the scales in favour of the lead of a small card is that if a player systematically adopt this course his original lead of Ace is always understood as from one of two hands, Ace to five, or Ace, Queen, Knave, to four or five,—the second card showing which of the two cases is in question.

It would be better if in dealing with play as in your letter you would call *A*'s partner *Y* and *B*'s partner *Z*, since that is the plan uniformly followed in our illustrative games. In the *Field* these players are called respectively *X* and *Y*; but if the first two letters of the alphabet are given to one pair of partners it is much more natural (and what is more to the purpose, more easily remembered) to give the other pair the last two letters. The *Australasian* for reasons inscrutable gives the letters *W* and *X*.

A. C. M.—It must be merely accidental. Assuredly there is no reason why, after a misdeal, rather than at any other time, one hand of the four should have but one card of a suit. What odds did you take against this event, by the way?

JABEZ.—I would rather not say *what* I think of "purposely hurrying the deal when the opponents have not claimed honours which they were entitled to." A true Whist-player would be apt rather to delay the placing of the last few cards—even if, without knowing his partner's feelings on such matters, he were unwilling to call the opponents' attention to their omission. Of course, if a player thinks more of the money for which the game is played than he does of the game itself, the case is different. We know what to think of *him*, do we not?

MERRY.—More merry I think than your partner felt. You had two trumps, the opponents had indicated no great strength in trumps, having neither signalled nor led trumps; and you had established a long suit; *therefore* you led a forcing card [!]; yet your partner complained that you had ruined his hand. Well you certainly went the right way about it. The chances were he held four trumps (as it turned out). He was likely to regard your force as showing you held four trumps too. In any case, he could not well let the trick pass, nor discard, except the singleton be held in your suit; for he would have had to unguard his King in the fourth suit. He ruffs; the enemy get in their best suits, and you lose two tricks and the game. Thanks wholly to yourself, I fear I must tell you.

Our Chess Column.

By Mephisto.

KING'S GAMBIT.

THE normal variation of this Gambit, as pointed out in our previous article, arises from the following line of play:—

1. P to K4 / P to K4 2. P to KB4 / P takes P 3. KKt to B3 / P to KKt4 4. B to B4 / B to Kt2

White has four modes of continuing the attack; by 5. P to Q4, P to B3, Castles, P to KR4; in any case, however, Black should maintain a superior game.

(*a*) 5. P to Q4 / P to Q3 (best)

6.	P to B3 / P to Kt5		Castles / P to KR3
7.	QB takes P (*a*) / P takes Kt	Q to Kt3 / P takes Kt	Kt to B3 / Kt to K2
8.	Castles / B to K3	B takes P (ch) / K to K2	P to KKt3 / P to Kt5
9.	B takes B / P takes B	Castles / Kt to KR3	Kt to R4 / P to B6 (*b*)
10.	Q to Kt3 / Kt to Q2	B to R5 / Q to Kt sq.	
11.	Q takes P (ch) / Q to K2	Q to B2 / B to Kt5	

(*a*) If 7. Kt to Kt sq. / Q to R5 (ch) 8. K to B sq. / Q to B3 White may also Castle, in which case the game would become somewhat analogous to the Muzio attack. By a transposition of moves, we arrive at the position given below in variation (*b*), *i.e.*,

7. Castles / P takes Kt 8. Q takes P / Kt to R3 9. QB takes P / Castles, &c.

(*b*) These variations mostly merge into each other; for the continuation of the above line of play see under heading of 5. Castles, when, by a transposition of the fifth and sixth moves, the same position will be brought about.

(*b*) 5. P to B3 (weak) / P to Kt5 (best)

6.	Castles / P takes Kt	P to Q4 / P takes Kt	Q to Kt3 / P takes Kt
7.	Q takes P / Kt to KR3	Castles / P to Q4	B takes P (ch) / K to K2
8.	P to Q4 / Castles	B takes QP / P to QB3	Castles / Kt to R3
9.	B takes P / P to Q3	KB takes P (ch) / K takes B	B to B4 / P to B3
10.	B takes Kt / B takes B	Q takes P / Kt to B3	P to Q4 / P to Q3
11.	B takes P (ch) / K to R sq.	P to K5 / R to B sq. (*a*)	R takes P / Q to Kt3 (*b*)

(*a*) It will be seen that in all these variations, some of which are of a very attacking character, Black maintains a superiority; the continuation of this variation is:—

12. B takes P / K to Kt sq. 13. B to Kt5 / Q to Q4 14. B takes Kt / Q takes Q 15. R takes Q / B takes B', &c.

(*b*) If White now exchanges Queens, he has not enough attack left to equalise the game. If he plays 12. Q to R3, Black can answer B takes P (ch) with advantage; the best continuation seems to be:—

12. Q to B2 / B to Kt5 13. R takes P / Kt to Q2 14. P to KR3 / B to K3
15. B takes B / K takes B 16. R to R4 / Kt to B2 17. Q to B2 / B to B3

(*c*) 5. Castles / P to Q3
6. P to Q4 / P to KR3

7.	P to B3 / Q to K2	Kt to B3 / Kt to K2	P to KKt3 / P to Kt5
8.	Q to Kt3 / Kt to Q2	K to R sq. / B to Kt5 (*b*)	Kt to R4 / P to B6
9.	P to Kt3 / P to Kt5 (*a*)	P to Kt3 / P takes P	P to B3 / B to B3
10.	QB takes P / P takes Kt	B takes P (ch) / K takes B	Kt takes P / P takes Kt
11.	R takes P / KKt to B3	Kt to K5 (ch) / K to Kt sq.	Q takes P / Q to K2
12.	P to K5 / P takes P	Kt takes B / P takes P	B to B4 / Kt to B3
13.	P takes P / Kt to Kt5	Q to B3 / K to R2	Kt to Q2 / B to Q2
14.	B takes P (ch) / Q takes B	P to K5 / P takes P	P to K5 / P takes P
15.	P to K6 / Q to R4	B takes P / P takes B	B takes KP / B takes B
16.	P takes Kt (ch) / B takes P	Q to B7 / Kt to Kt3	B takes P (ch) / K to Q sq.
17.	P to KR4 / Castles QR	Kt to K4 / White wins	P takes B / Kt takes P (*c*)

(*a*) If P to KR4, then Kt to Kt3.

(*b*) We give this variation for purposes of attack. Black, however, would do better to play either B to K3 or Castles, with a safe game.

(*c*) Continuing with:—

18. Q takes P / Q to B4 (ch) 19. R to B2 / B to B3 20. Q to Kt3 / Kt to Q6, and wins.

Problems received with thanks from Tom, F. G. D., H. W. Sherrard.

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Note.—*All communications respecting Lectures should be addressed to Mr. John Stuart, Royal Concert Hall, St. Leonards.*